Test note of 1.3GHz single-cell cavity TE1AES004 9th VT in A0

Mingqi and Elvin

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The brief history of this cavity:

1.3GHz single-cell Cavity TE1AES004 was manufactured by AES Corporation, and BCP'd 107μm; EP'd 65μm; and baked 120C 48 hrs. A huge pit was found by Kyoto inspection machine. The 5th, 6th, 7th and 8th tests in IB1 and A0 showed the cavity quenched at Eacc=37~39MV/m and non-FE. The cavity was kept under vacuum since last vertical test. Last VT showed that the cavity quenched at pit, this test is to confirm that test result further. We put 4 fast thermometers around the pit location.

The process and test results:

Before pumping down, the cable was calibrated. The cable loss factors are Cf=34.015, Cr=35.73, and Ct= 5.93. The data is closed to last 1.3GHz cavity test data. The average Qt value equal 5.19E12, which was measured 3 times from Eacc=5.508MV/m to 7.018 MV/m at 2K. During the Eacc vs. Q0 measurement, the X-ray started at 19.7MV/m, and first quench happened, after that processing started and several quenches happened. The cavity finally quenched at 32.5MV/m, and Q0=6.18E9, X-ray radiation level was very low. Fig1 is the Eacc vs. Q0 curve.

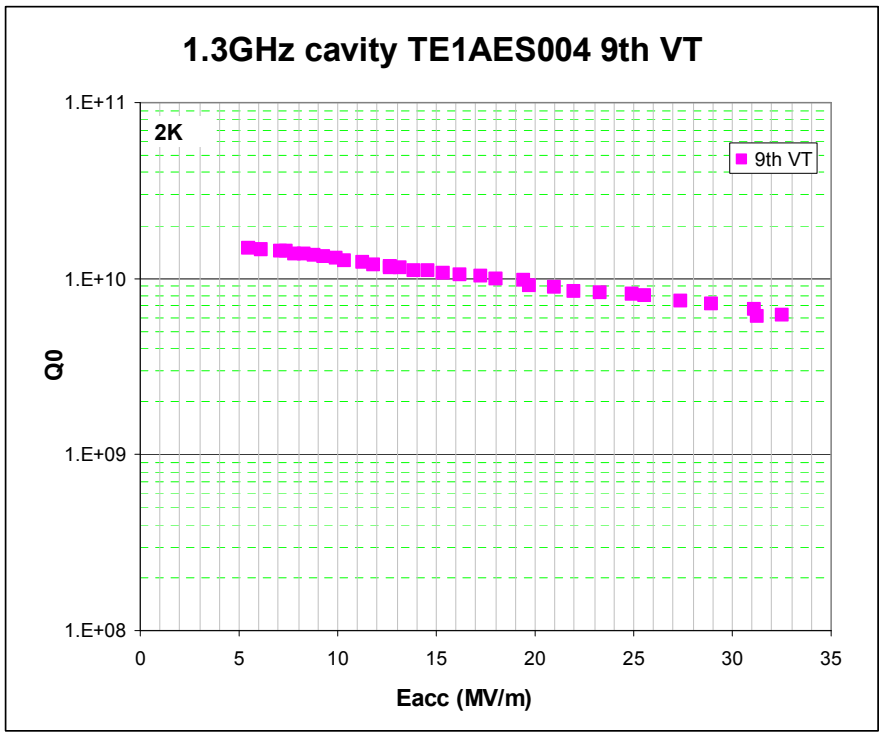


Fig1

Comparison to previous VT

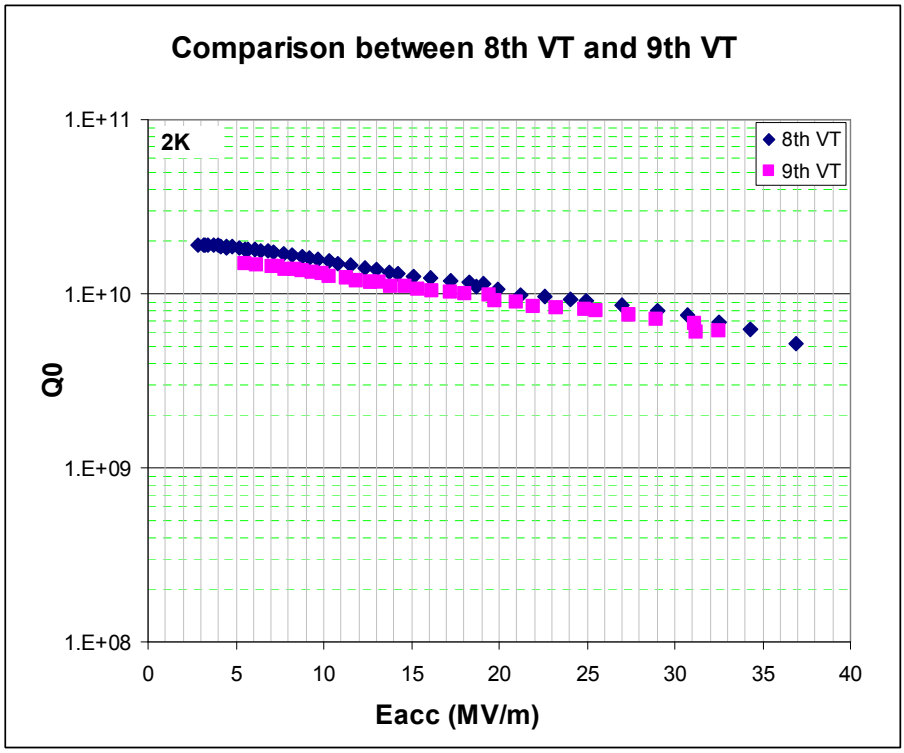


Fig 2

This test showed the quench field 5MV/m lower than before, the table1 is the comparison of calibration data and Qt, the table 2 is the power level and radiation comparison.

Table 1

	Cf (dB)	Cr (dB)	Ct (dB)	Qt
8th VT	33.63	35.86	5.99	5.08E12
9th VT	34.02	35.73	5.93	5.19E12

Table 2

	Pf (dBm)	Pr (dBm)	Pt (dBm)	Eacc (MV/m)	X-ray (counts/mins)
8th VT	45.38	27.92	15.34	36.9	>30,000
8th VT	43.3	32.40	14.25	32.5	15,000
9th VT	43.77	32.75	14.16	32.54	>30,000

From the Table 1 and Table 2, we know the cable calibration is no problems and Qt is also about same, the power level at 32MV/m is same between 8th VT and 9th VT, and also 5th VT in IB1, 7th, 8th and 9th VT in A0 showed the processing started at 20MV/m. This information suggests that this test is accurate and the cavity quenched earlier than before. The X-ray was larger than before, could this account for the 5MV/m loss? We don't know yet.

Heating of quench location

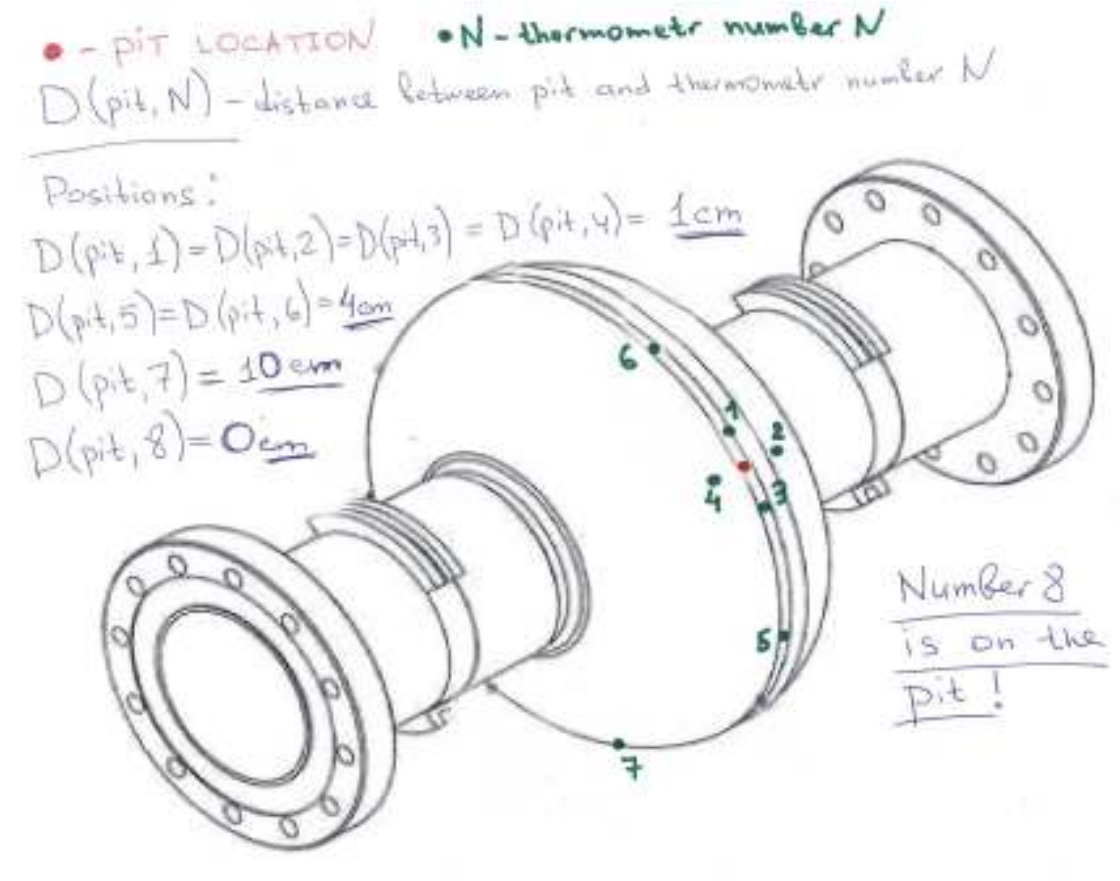


Fig 3

We prepared 8 fast thermometers and attached them on the cavity where showed as Fig3. Fast thermometer No.8 was right on the pit location (red spot in Fig3), Fast thermometer No.1~No.4 were 1 cm away surrounding the pit, No.5 and No.6 were 4 cm away on the equator welding seam, the No.7 was 10 cm away on the equator.

Before the quench (the power level jus a little bit lower that quench field), none of fast thermometers showed temperature rising (Fig 4).

Fig 4

During the quench, the fast thermometers showed temperature dramatically rising (Fig 5). The temperature peak value of No.3 was about 17K.

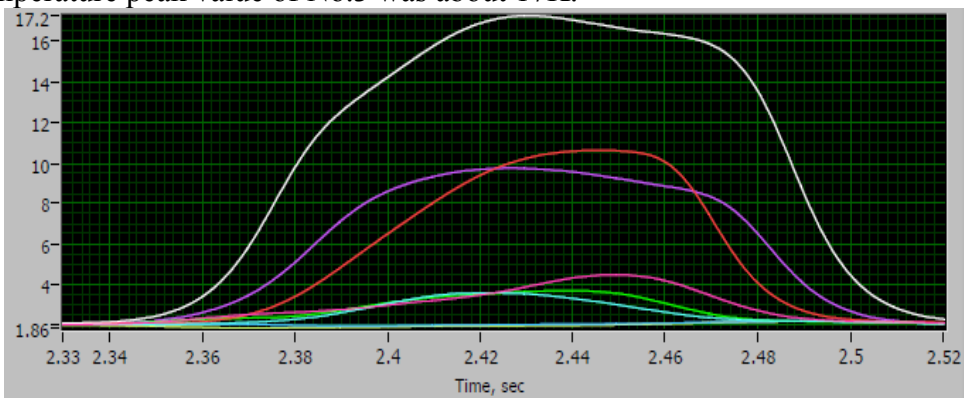


Fig 5

But a while later, the No.3 peak value dropped to 7K, and No.4 and No.8 also dropped a little bit, the No.1 was arise to 7K(Fig6).

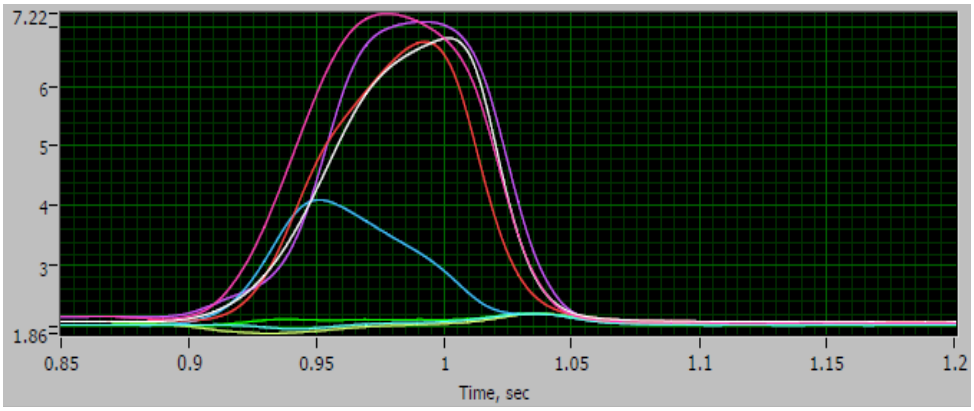
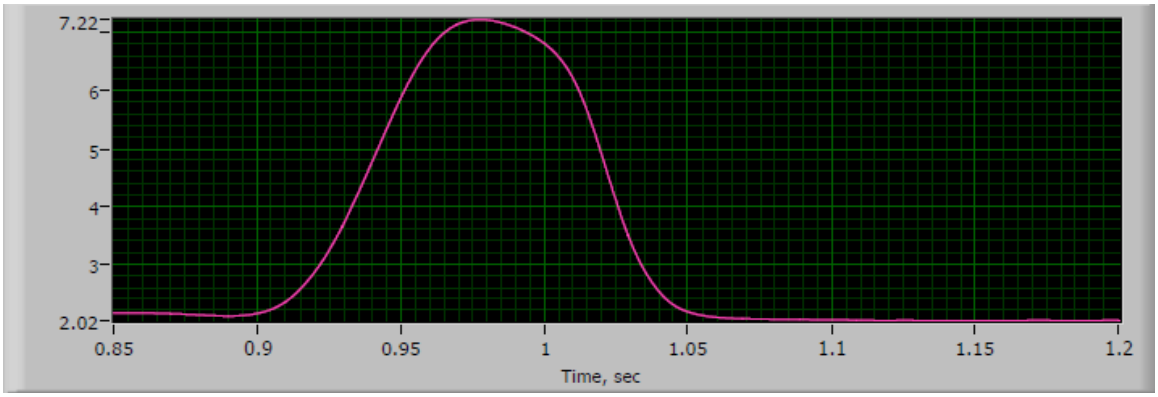


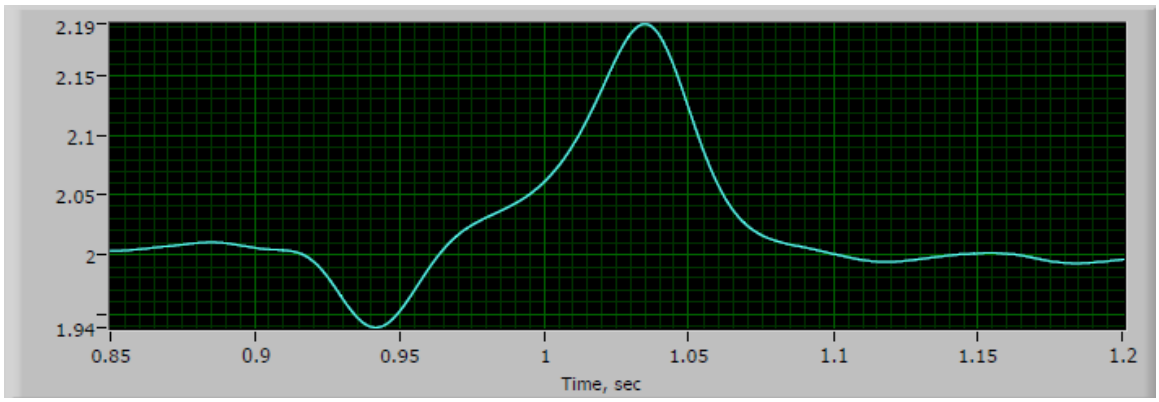
Fig 6

The following Figs are the No.1~No.8 thermometers temperature pulses.

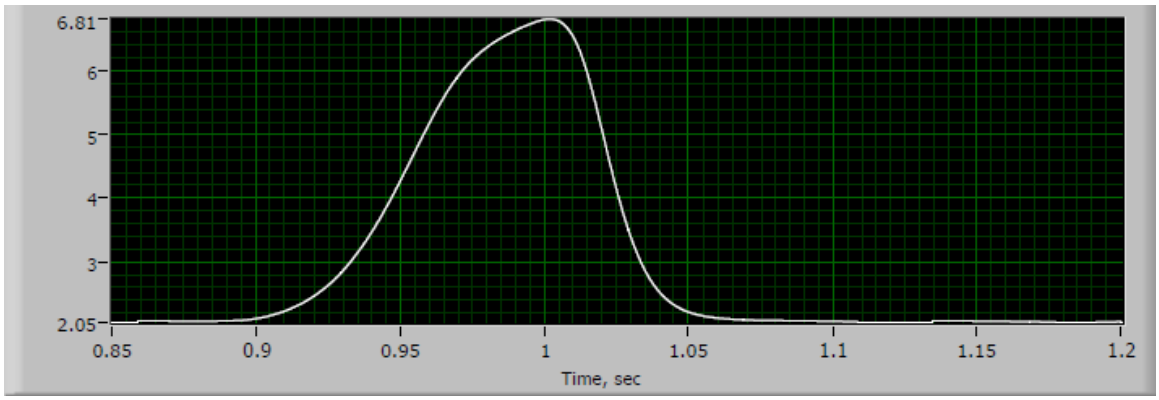
No.1



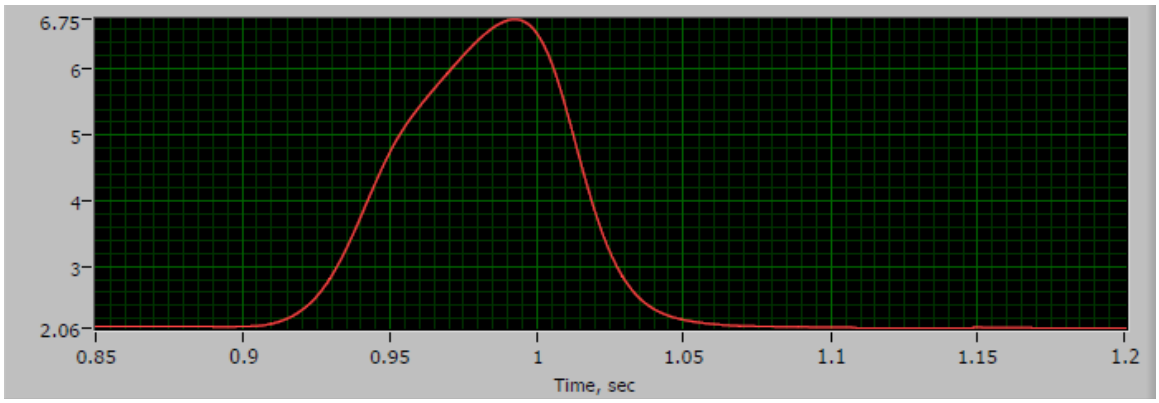
No.2



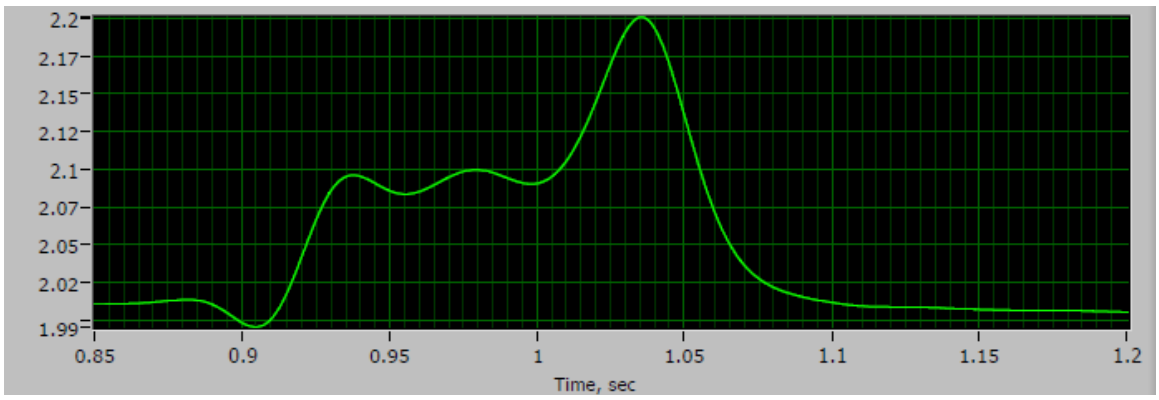
No.3



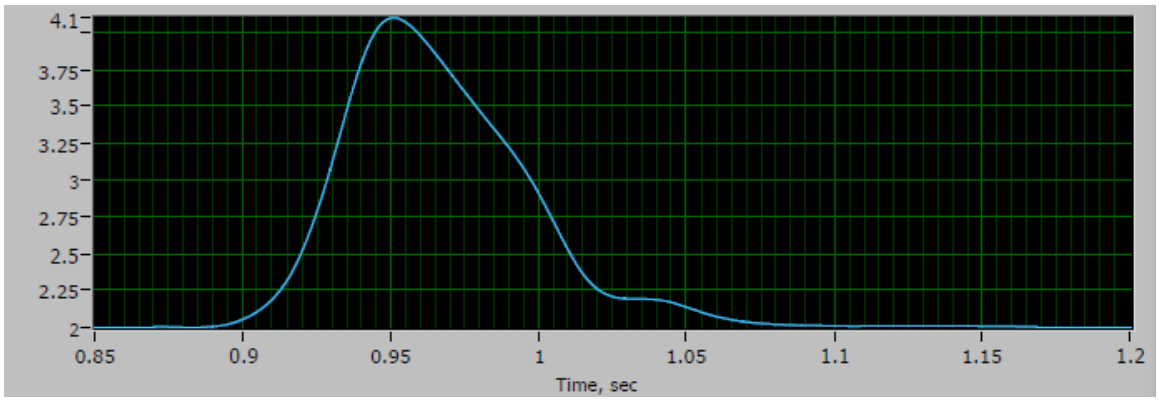
No.4



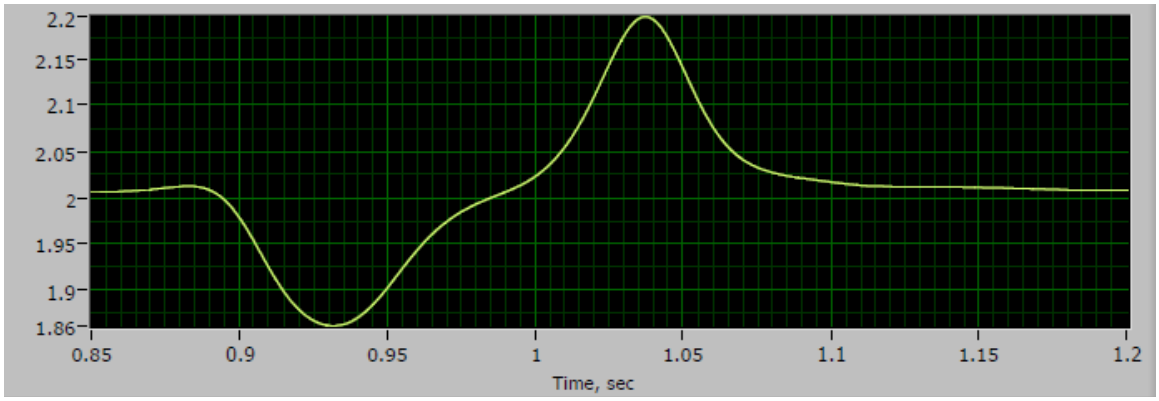
No.5



No.6



No.7



No.8

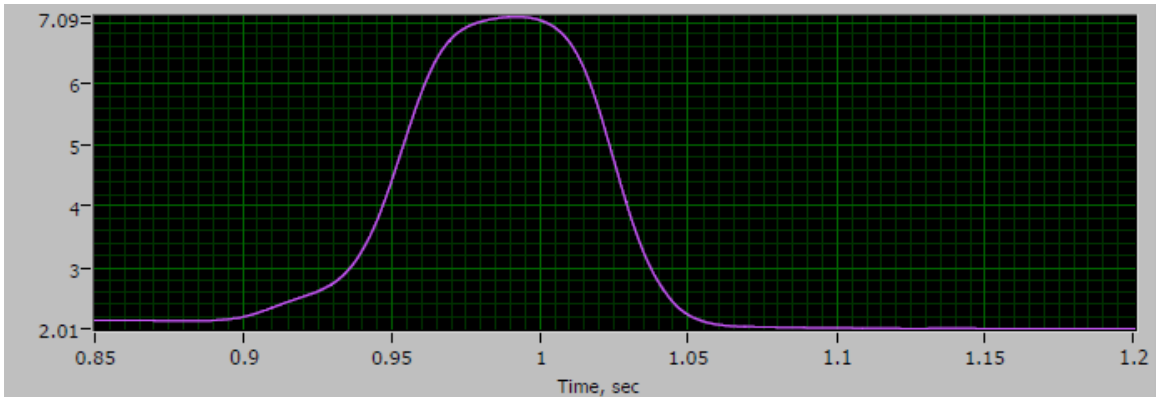


Table 3 is the summary of the temperature values, the pulses duration was 0.1 second.

Fast thermometer	Temperature peak	Distance to pit
No.1	7.22K	1 cm
No.2	2.19K	1 cm
No.3	6.81K	1 cm
No.4	6.75K	1 cm
No.5	2.2K	4 cm
No.6	4.1K	4 cm
No.7	2.2K	10cm
No.8	7.09K	0 cm

Conclusion

1. The cavity quench field dropped to 32.5 MV/m.
2. The cavity quenched at pit.
3. No pre-heating was observed.